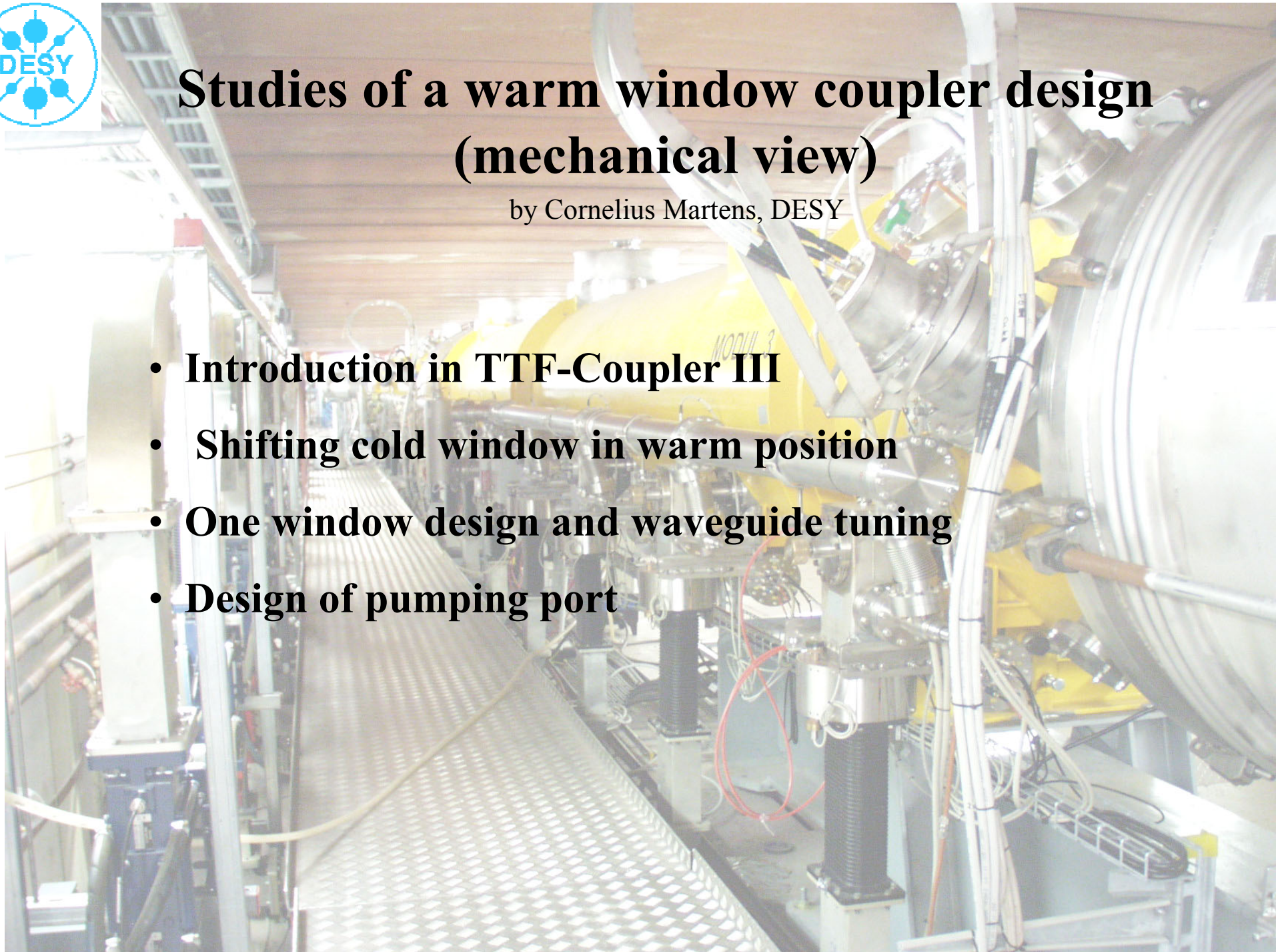# Studies of a warm window coupler design (mechanical view)
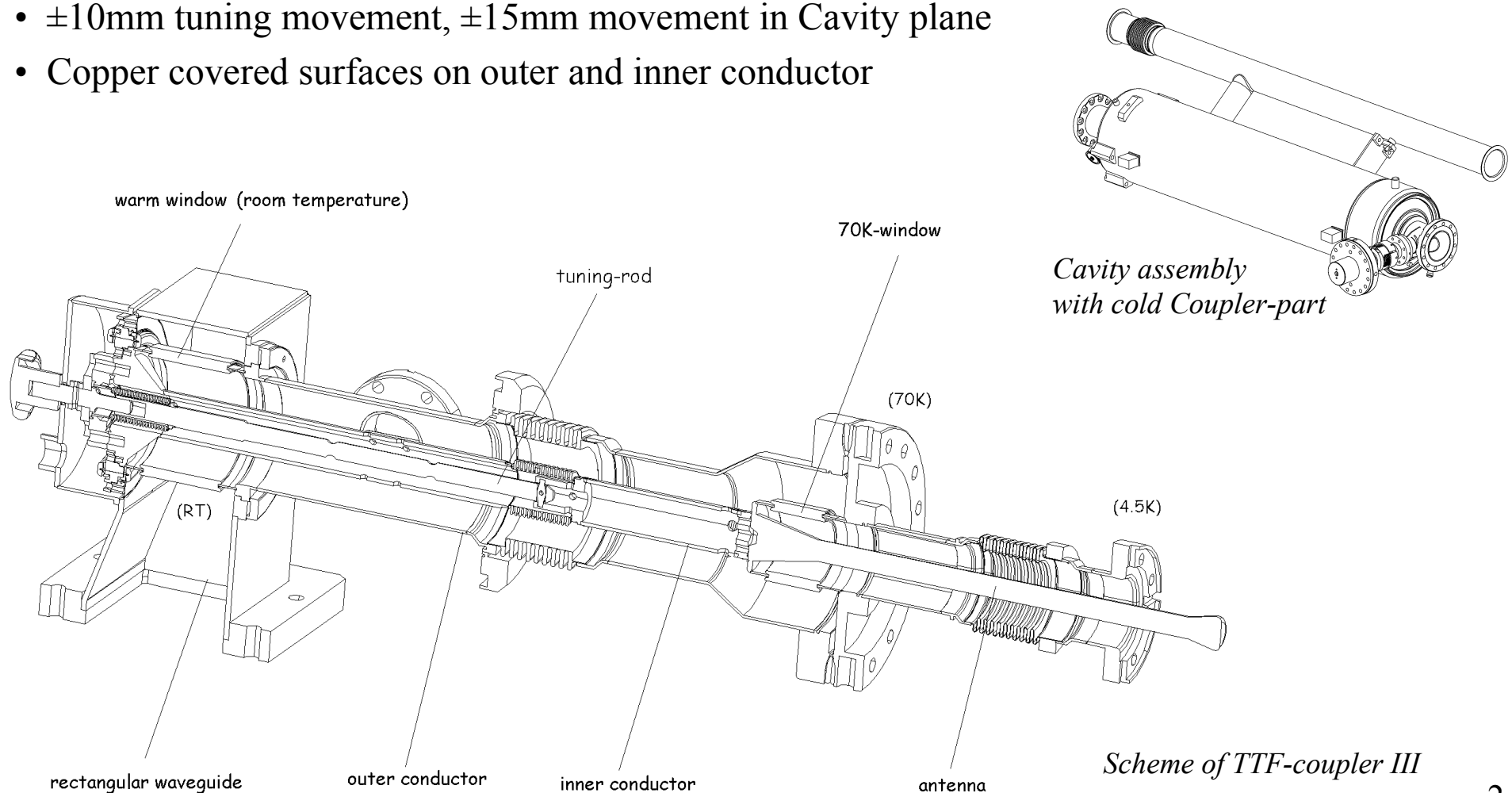
by Cornelius Martens, DESY

- **Introduction in TTF-Coupler III**

- **Shifting cold window in warm position**

- **One window design and waveguide tuning**

- **Design of pumping port**

Introduction in TTF-Coupler III

- Third design of coaxial couplers at DESY
- Two windows system with cold window (70K) and warm window (RT) in coaxial line
- Seperate cold part for cavity assembling
- Three Bellows in coaxial line, one for tuning-rod.
- mechanical tuning for both parts: antenna and cold window
- ±10mm tuning movement, ±15mm movement in Cavity plane
- Copper covered surfaces on outer and inner conductor

*Cavity assembly
with cold Coupler-part*

warm window (room temperature)

70K-window

tuning-rod

(70K)

(RT)

(4.5K)

Scheme of TTF-coupler III

rectangular waveguide   outer conductor   inner conductor   antenna
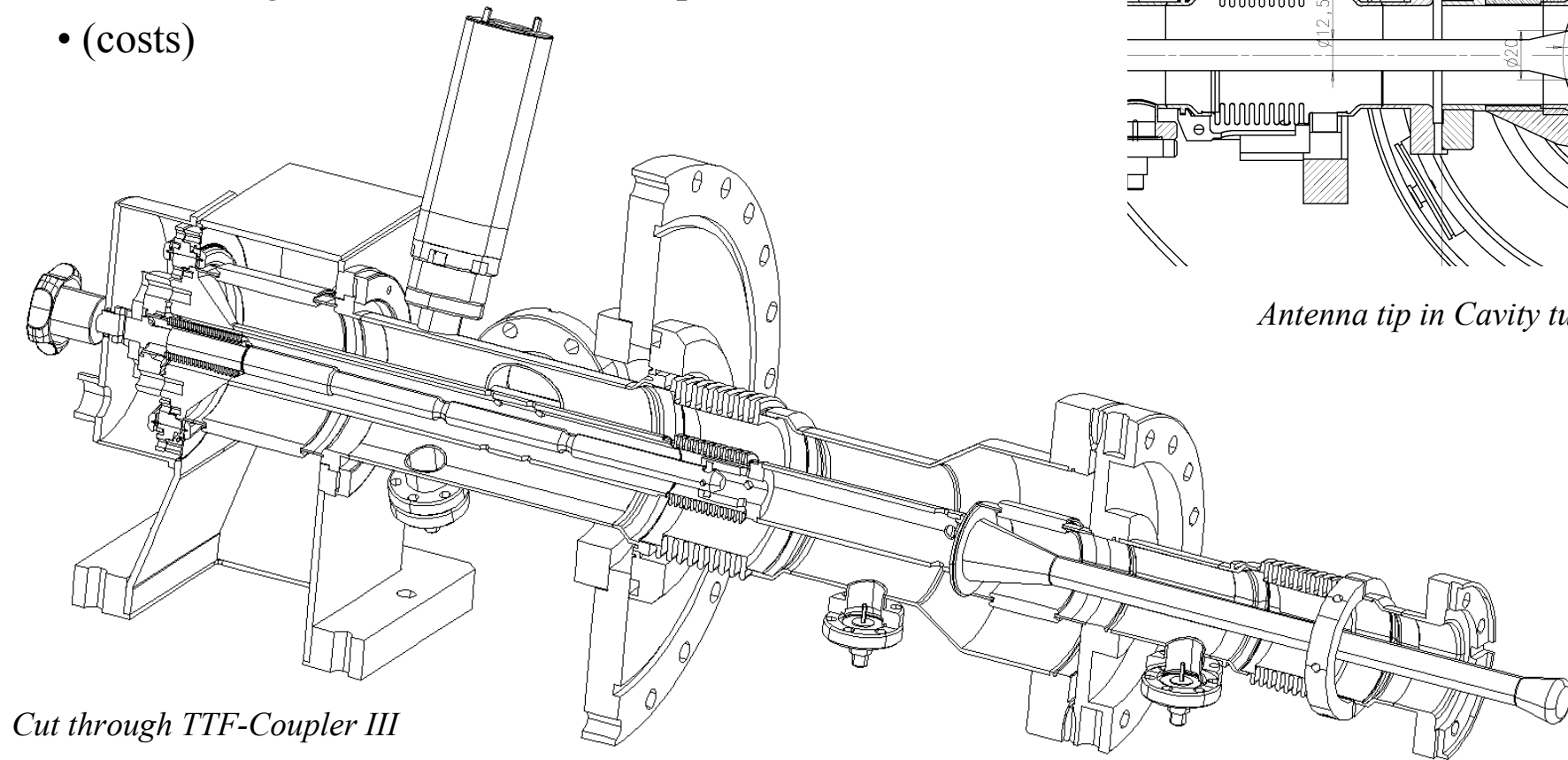
2

TTF-coupler-III in Detail

Problems of existing design

- Unclear antenna tip position in Cavity tube

   (system with two bellos is under constraint)
- Pumping crossection is too small
- Conditioning time is too long
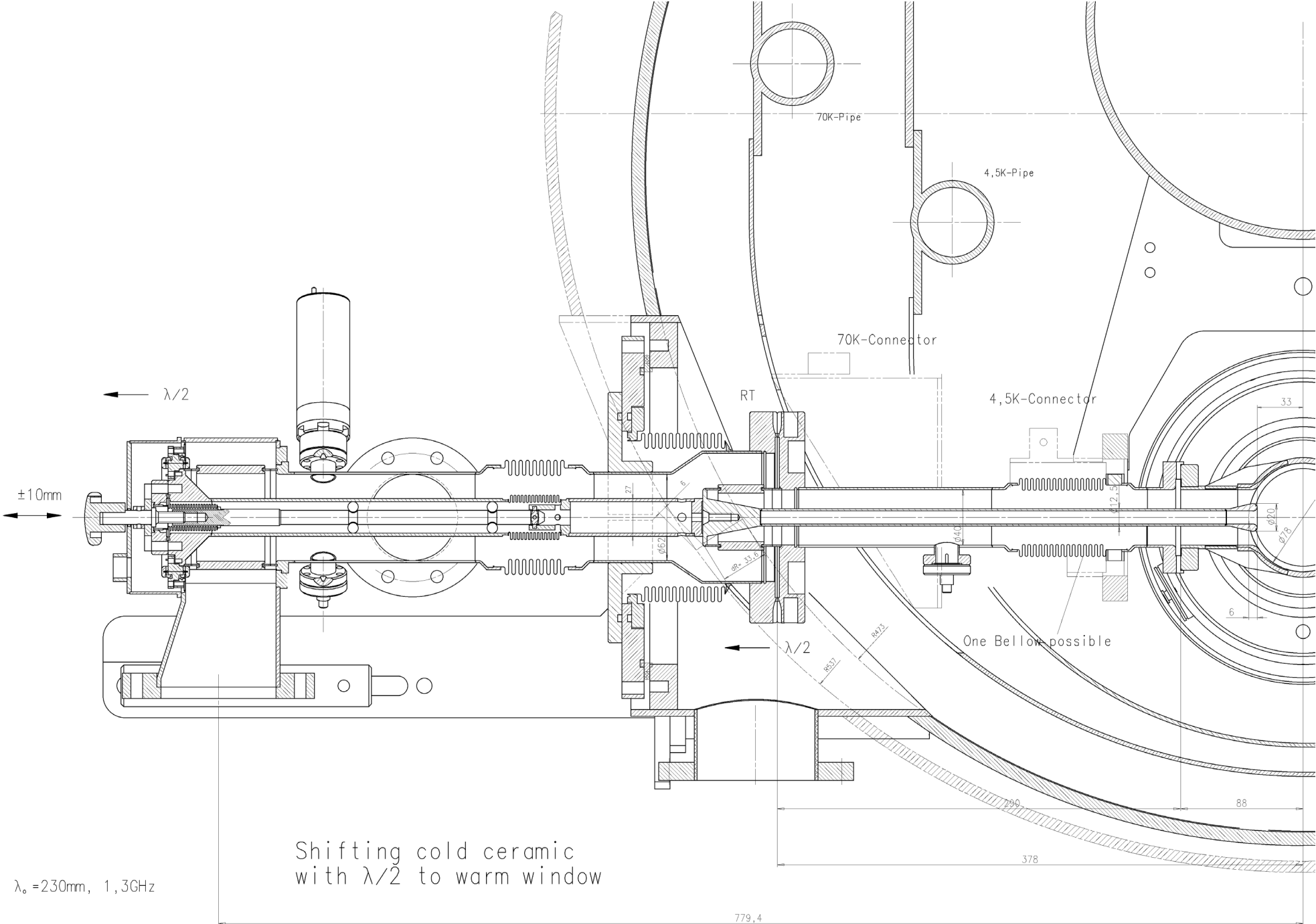
   => Shifting cold window in warm position
- (costs)
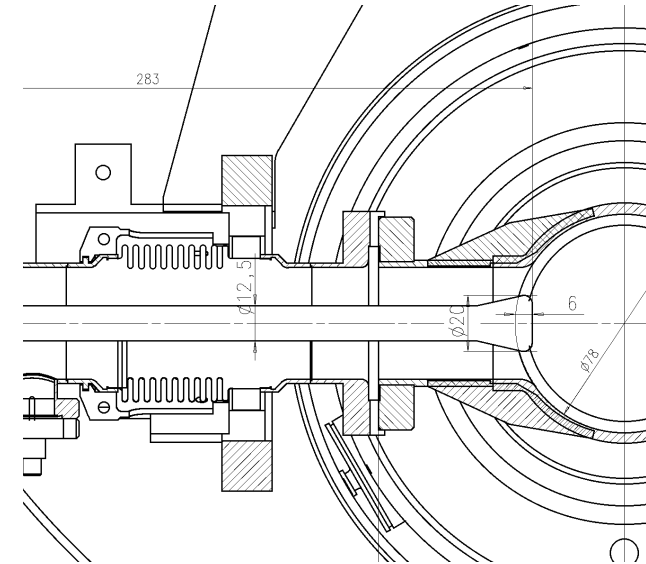
Antenna tip in Cavity tube

Cut through TTF-Coupler III

Shifting cold window in warm position

$\lambda/2$

$\pm 10\text{mm}$

70K-Pipe

4,5K-Pipe

70K-Connector

4,5K-Connector

RT

33

$\lambda/2$

One Bellow possible

R473

R37

$\varnothing 62$

$\varnothing 40$

$\varnothing 12,5$

$\varnothing 20$

$\varnothing 78$

27

6

6

dR= 33,6

299

88

378

779,4

Shifting cold ceramic
with $\lambda/2$ to warm window

$\lambda_o =230\text{mm}, \ 1,3\text{GHz}$

Problems and activities when shifting cold window

- Modifications of cryogenic-vessle (RF- and mounting concept doesn´t change)
- Antenna is longer => risk of antenne deformation => new antenna design
- Harmonic bellow concept => new bellow design and RF-simulation is necessary
- Position of antenna tip was unclear => guider for bellows

Bellow guider
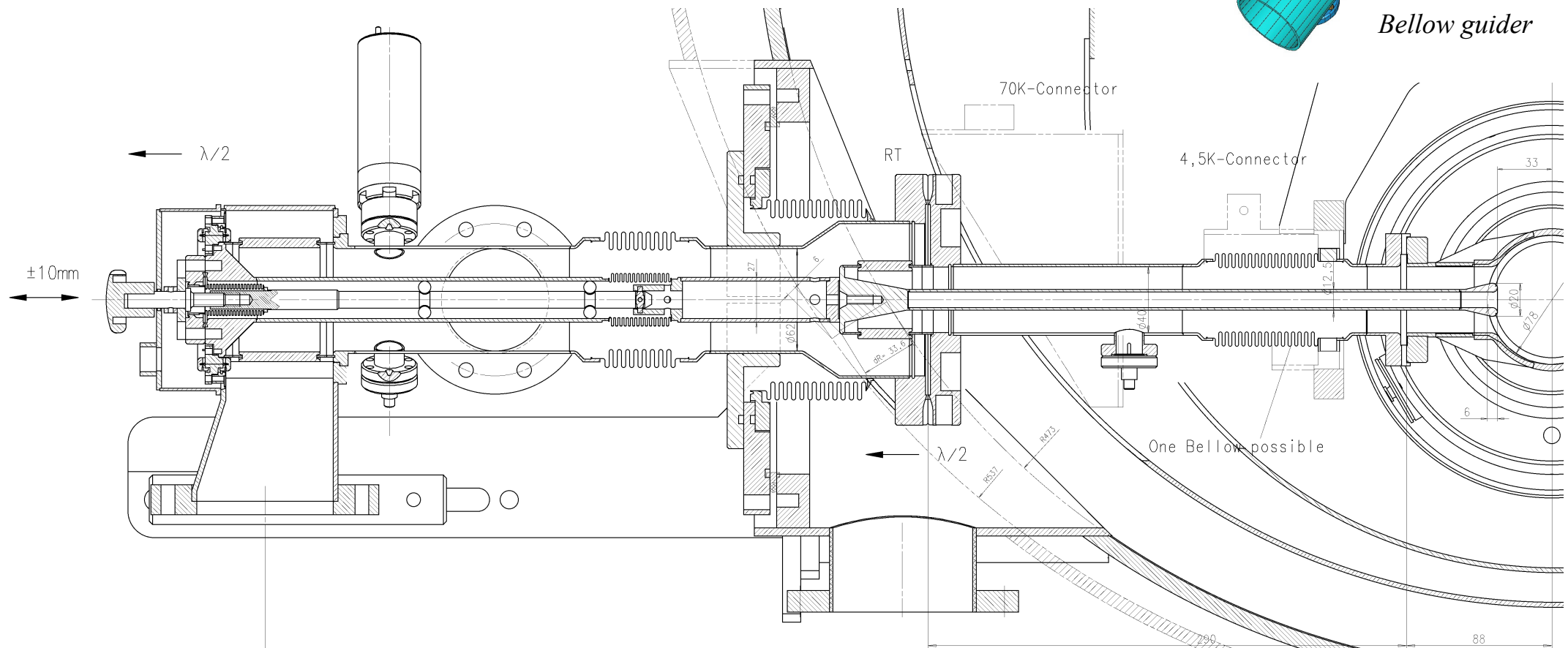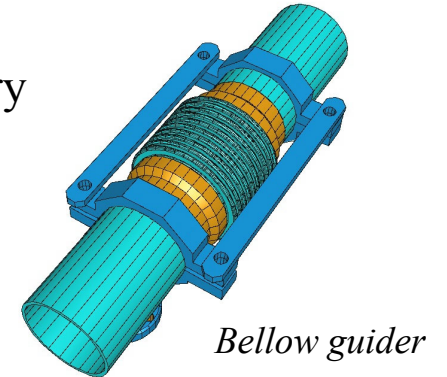
Design for a „light" antenna
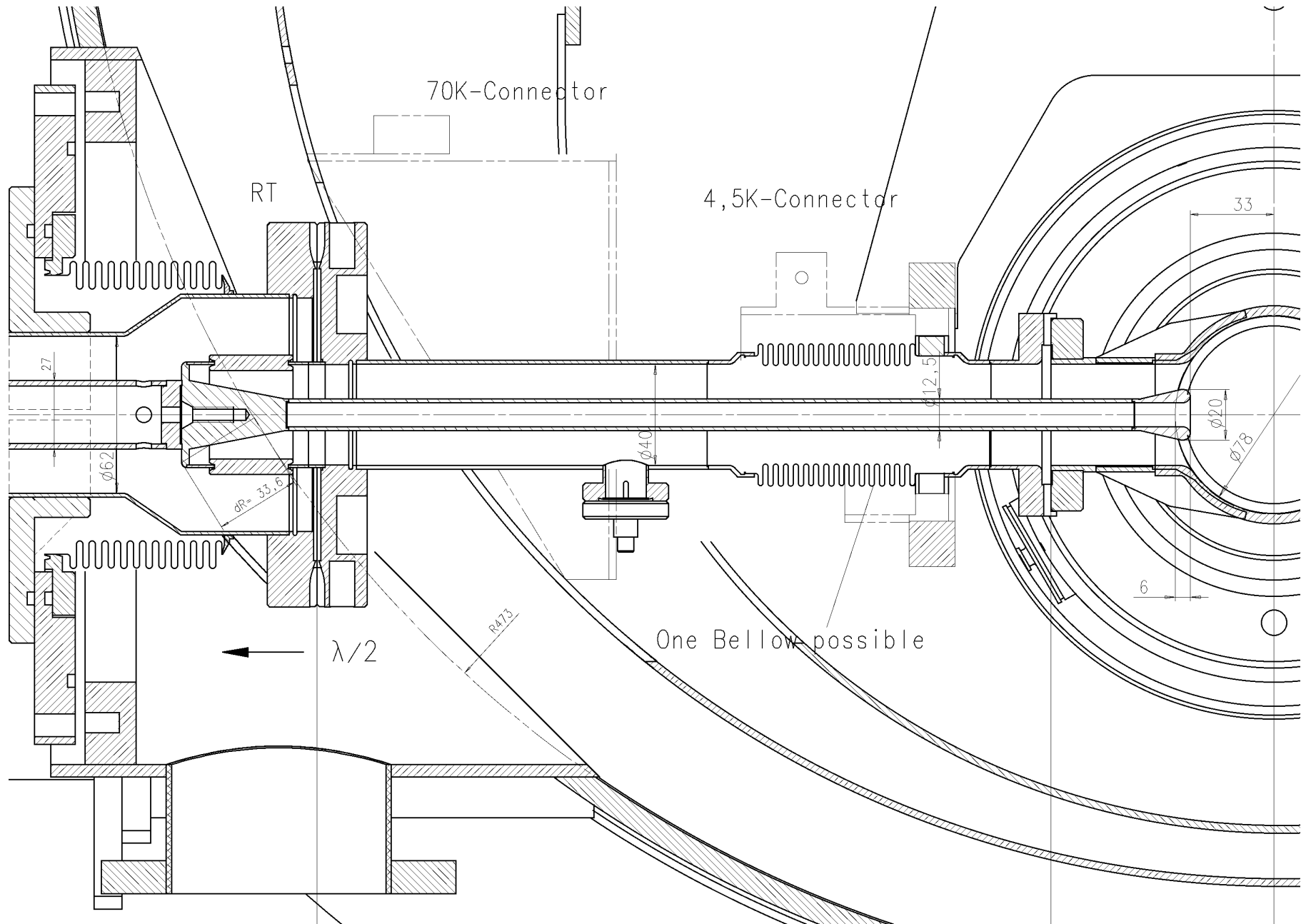
One window design

Only one warm window in coaxial line:

- Warm window temperature must be clear (contact conditions and heat flow: 4.5K, 70K, RT)
- Atmosphere must be clear (for example waveguide in SF6)
- New RF design for WG transition and Bias is necessary

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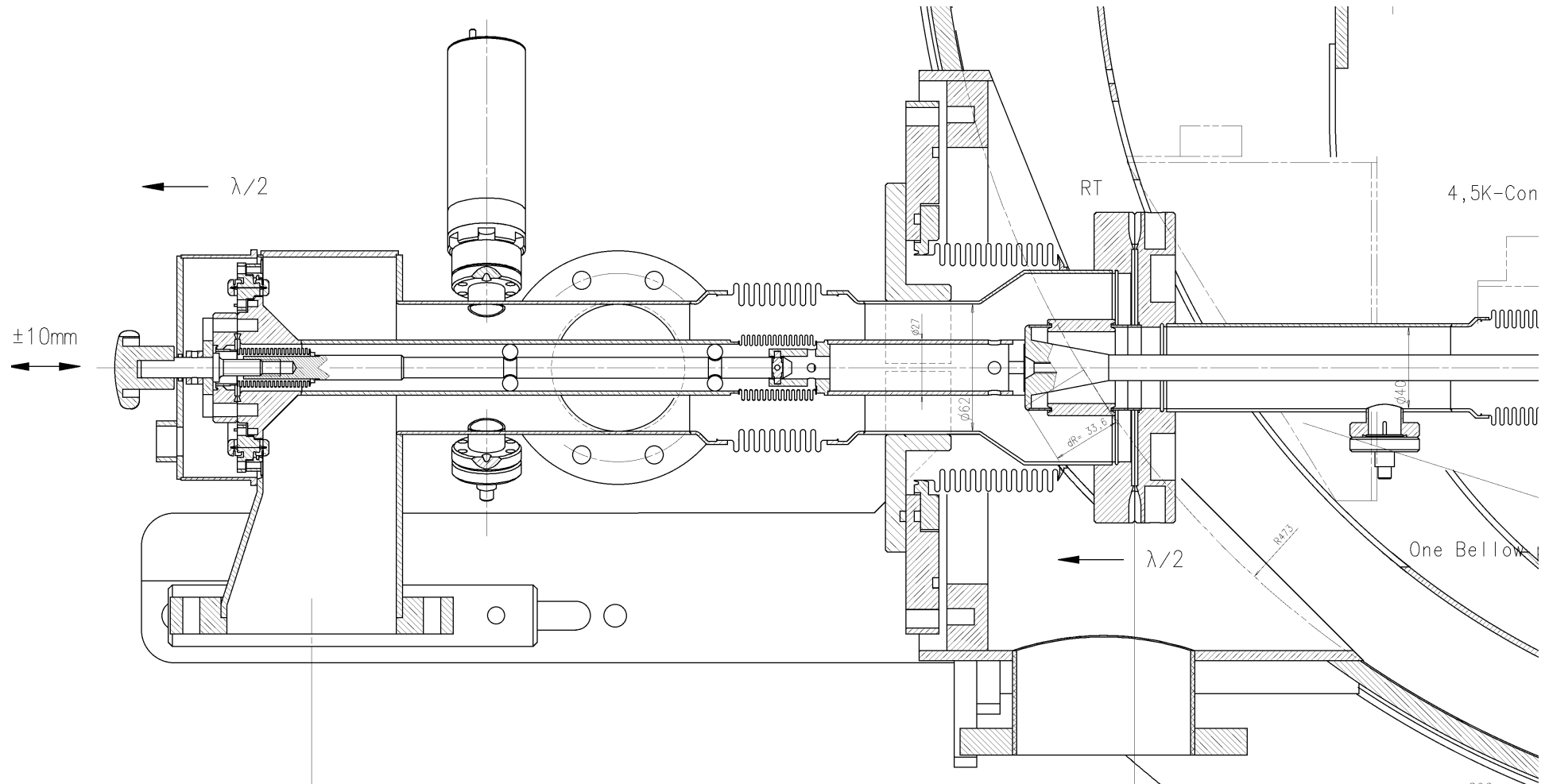
Waveguide tuning

Reducing costs with tunable waveguide?

- Three instead of four bellows, no tuning rod. But:

  Bellows in WG-system are necessary for mechanical tuning

- Moving by stepping motor is possible

- Guider for WG is necessary for mechanical tuning

- Tuning by WG– tuner is thinkable (Stub tuner)

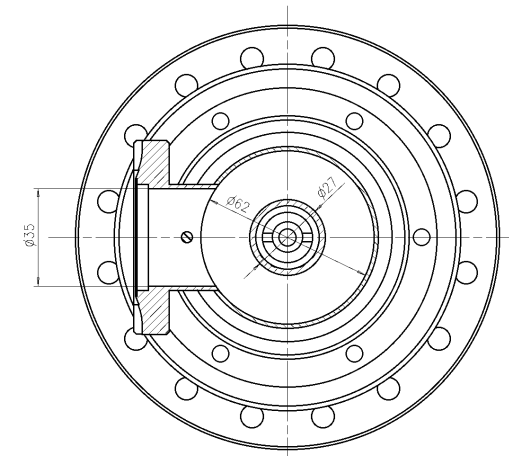 => additional costs

±10mm movement
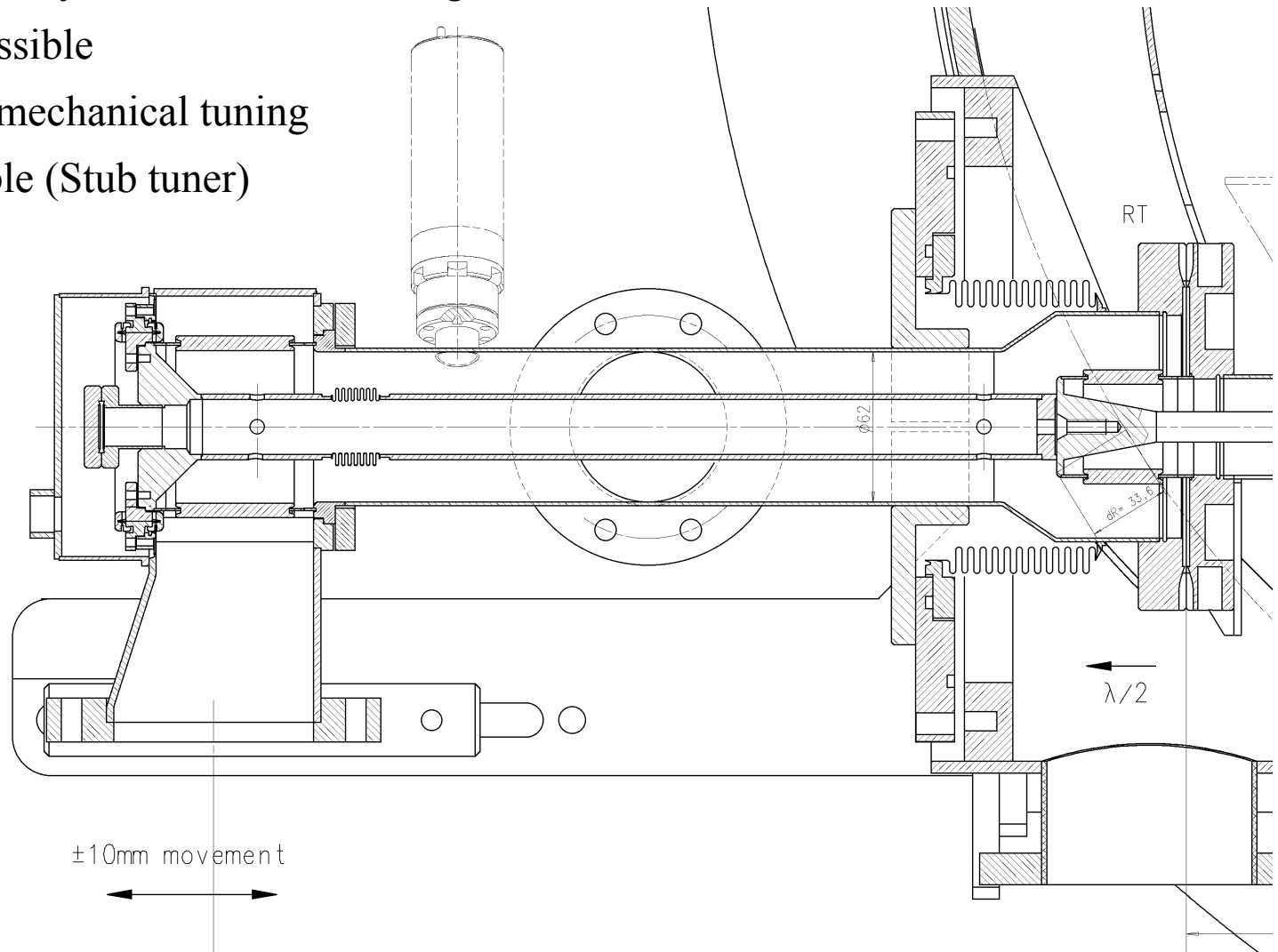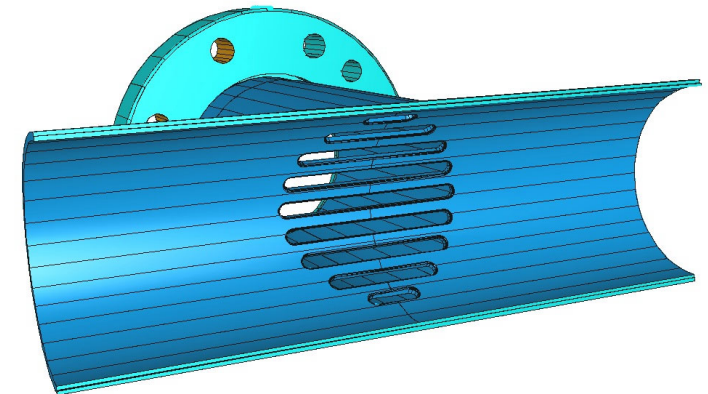
Design of Pumping Port

How to increase pumping power:

- bigger crossection

  (CF63 instead of CF35, CF63 cutted)

- increase number of pumping-ports

  for example: 4mm Slots, 9x

Crossection of „warm part"

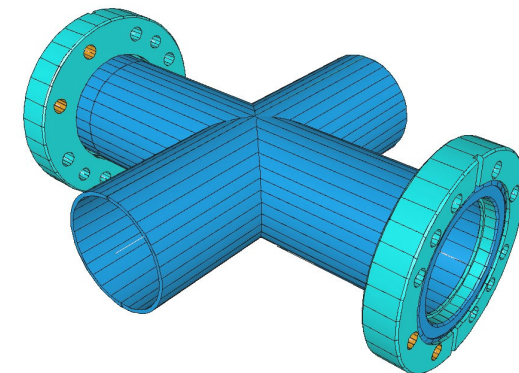| Version	Crossection/mm² (%)
Koax Ø62x27	2447 (100%)
CF35 (TTF-Coupler III)	962 (39%)
CF63, 9x slots	1433 (59%)
2x CF63, slots	2866 (117%)

Tab: Koax. crossection and pumping crossections for diff. designs

Pumping port with slots

Two instead of one port

Summary

- **Shifting cold window means a redesign of the crygenic vessle => one instead of two windows is useful**

- **Mechanical tuning of waveguide seems possible and easy but won´t reduce costs**

- **Redesign of pumping port and bellow guider is necessary**

- **Reducing costs: simplify geometry and reducing the number of parts. Perhaps: Minimize funktionality (What is not necessary? Which diagnostics?)**

(Rotate cold part in down position)

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